

### Development of Ocular Inserts and Aptamer-Based Delivery Vehicles for Sustained Release of Ocular Therapeutics and TCM Products

#### Principal Investigators

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#### Aims

Develop two synergistic drug delivery systems for treating dry eye disease (DED): one utilizing aptamers and the other using ocular inserts, while also discovering new therapeutic agents derived from traditional Chinese medicine (TCM).

#### Background

The eye's complex physiology and anatomy challenge effective drug delivery to both anterior and posterior segments. Advanced drug delivery methods are needed for better compliance and efficacy.

#### Work to be Done

Preclinical animal studies will evaluate the efficacy and safety of liposomes engineered with cornea-binding aptamers to deliver an established drug for DED. A pilot scale-up study will test the efficacy and safety with other dry eye drugs and TCM compounds. Success will lead to extending the aptamer-based delivery to the posterior eye segment. Ocular inserts will be developed with biomaterials that can degrade upon exposure to tear film elements or external triggers like cysteine/glutathione or phosphatase in the tear film, and evaluated for biocompatibility, degradation kinetics, handling, and safety using in vitro models. Incorporation of ocular inserts with drugs, aptamer-based delivery vehicles, and TCM will also be explored. The cell-on-a-chip device (developed in RP2.2s) will be used to screen TCM decoctions, herbs, or active compounds selected per the Pharmacopoeia of the People's Republic of China for effectiveness against DED, compared to conventional treatment. This will result in the first-ever Natural Drug Candidate Compilation for dry eye treatment.

#### Benefits

The combination of these therapies will offer comprehensive treatment for both immediate symptoms and long-term management of DED, significantly benefiting patients with this highly prevalent condition by providing more effective treatments that reduce side effects and improve quality of life. Healthcare providers will gain access to advanced treatment tools, enhancing patient care and reducing costs. Pharmaceutical companies will benefit from the drug database and delivery platform, fostering technology transfer and commercialization. Collaboration with Traditional Chinese Medicine (TCM) practitioners will promote TCM globally and provide evidence-based treatments.

#### Impact

Advancements in ocular drug delivery and screening will improve treatments for various eye conditions. Patients with posterior segment diseases like diabetic retinopathy and macular degeneration could benefit from new treatments using aptamer-based delivery systems.



Improved delivery of drugs and TCM formulations to the eye